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Setting $AB + AC = K$, a knowledge of the fundamental properties of tangents to a parabola makes the following construction self-explanatory:—

Lay out on AB, AC, respectively, AX, AY, each equal to K. Draw AN through N, the middle point of XY. V, the middle point of AN, is the principal vertex of the parabola mentioned above. Draw VZ perpendicular to AV, cutting AX in Z; then ZS perpendicular to AX, cutting AN in S, the focus of the parabola. Over SP as a diameter draw a circle cutting VZ in Q,R. Draw PQ, PR; these are tangents to the parabola and cut AX, AY in B,C, giving two constructions. [*R. D. Bohannan.*]

EXERCISES.

51

A QUADRILATERAL, both circumscriptible and inscriptible, has a given perimeter $4s$ and one given angle α. Show that its area is

$$2s^2 : (\operatorname{cosec} \alpha + \operatorname{cosec} x)$$

where x is one of the angles adjacent to α. And find x when the area is greatest. [*W. M. Thornton.*]

52

FIND the height to which the Washington Monument must be built so that a body placed on top of it would have no weight. [*A. Hall.*]

53

SHOW that when $x = \frac{2\pi}{13}$

$$(\cos x + \cos 5x)(\cos 2x + \cos 3x)(\cos 4x + \cos 6x) = -\tfrac{1}{8}.$$

[*R. H. Graves.*]

54

SHOW that if in a plane triangle ABC

$$\cos A + \cos B + \cos C = \sqrt{2},$$

the centre of the circumscribed circle lies on the circumference of the inscribed circle. [*R. D. Bohannan.*]

55

What is the locus of the vertex of a variable angle whose sides intercept a fixed line and whose bisectrix passes through a given point in that line.

[*L. G. Carpenter.*]

SELECTED.—CONSTRUCTIVE PROBLEMS IN ELEMENTARY GEOMETRY.

56

Construct a triangle; given its circumscribed circle and the radii which bisect its sides.

57

A transversal through the point O intersects the lines a,b,c in the points A,B,C; construct the transversal on which OA equals BC.

58

Divide an isosceles triangle by perpendiculars from a point within it to the sides, into three equivalent quadrilaterals.

ADAPTED FROM ARCHIMEDES, DE SPHÆRA ET CYLINDRO.

59

Show that the height of a cone bears to the height H of an equal spherical dome of diameter D on the same base the ratio

$$3D - 2H : 2D - 2H.$$

60

Divide a sphere by a secant plane into two segments whose entire surfaces shall be as 1 to 3.

61

Divide a sphere by a secant plane into two parts whose volumes shall be as 1 to 3.

62

Find the radius of a spherical dome whose volume is 2000^{cf} and whose altitude is ⅔ of the radius.

63

Find the radius of a spherical dome whose surface shall be 2000^{sf} and whose altitude is ⅔ of the radius.